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ABSTRACT

Technological delivery systems currently available or in use are examined for adaptability by rural schools, especially high schools faced with increasing demands to expand curriculum. This report focuses on the Mid-Continent Regional Educational Laboratory's (McREL's) service area of Colorado, Kansas, Missouri, Nebraska, North Dakota, South Dakota, and Wyoming, but the information would be useful to policymakers concerned with rural schools in other regions. Descriptions, expenses, and advantages are given for audio teleconferencing, videotape lessons, interactive television, interactive video, and computer networks. Profiles are provided for 20 projects employing modern informational or telecommunications technologies to expand instructional access or quality. Project description, implications for rural schools, costs, comments about enrollments, evaluations, alterations, and name/address of contact person are provided for each project. A chart lists information about technology-oriented delivery systems already available in McREL's seven-state area. The report emphasizes delivery systems which schools could employ immediately without tremendous expense and those which combine technologies with face-to-face supervision. Practical advice for choosing technologies emphasizes practicality, resource sharing, overcoming political barriers to change, and adapting principles of successful entrepreneurship when implementing new technologies. (LFL)

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REPORT UPDATE

INFORMATION TECHNOLOGIES:

ALTERNATIVE DELIVERY SYSTEMS FOR RURAL SCHOOLS

A Report to the

Mid-continent Regional Educational Laboratory

Paul Nachtigal, Rural Education Project Director
C.L. Hutchins, Executive Director

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RC015758

By
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Lincoln, Nebraska

November 20, 1985

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PREFACE

This is an update of a report first commissioned in 1984 by the Mid-continent Regional Educational Laboratory (McREL) as one response to new challenges facing rural school districts.

Among those challenges are increasing demands upon all high schools to offer expanded curricular opportunities, especially in those disciplines directly associated with a renewed emphasis on educational excellence.

Such disciplines typically include foreign languages, mathematics and the sciences, as well as disciplines often associated with enrichment, such as art and music.

Through its rural education program, McREL encourages finding creative solutions to problems unique to rural schools in its service region: Colorado, Kansas, Missouri, Nebraska, North Dakota, South Dakota and Wyoming.

While the information included here was prepared specifically for school policy makers in these states, schools throughout the nation face similar challenges. Thus the information contained in this report may be useful to rural schools located elsewhere, as well.

Milan Wall
Lincoln, Nebraska
November 20, 1985

INTRODUCTION

This report focuses on three topics of potential interest to rural school policy makers:

1. Technological delivery systems currently available or in field test stages which rural schools might use to expand or enrich curricula for high school students facing new graduation or college entrance requirements.

2. Profiles of 20 projects, each employing modern informational or telecommunications technologies to expand access or quality for instructional offerings.

3. Information technology-oriented delivery systems already available throughout the McREL service area which might be employed by rural schools in response to problems of curricular breadth or depth.

While information is contained here on such highly advanced technologies as direct satellite communications and interactive videodisc, the focus of the report is on those delivery systems that schools might employ immediately.

Current availability was one of several operating assumptions which guided the preparation of these materials. Among others:

* Resource sharing among schools -- such as sharing of teachers or costs of equipment and operations -- is a probable model for rural schools.

* Schools will respond more favorably to those technologies which are not only currently available but also subject to trial without tremendous expense.

* Delivery models should take into account some combination of technologies and face-to-face supervision or direction.

* Different schools will respond to different models as holding the most potential for their respective situations, and thus no one model will solve all schools' problems.

INFORMATION TECHNOLOGIES AVAILABLE TO RURAL SCHOOLS

A variety of information technologies have been adapted recently for use as carriers of educational materials. Ranging in sophistication from a network of telephone lines to a network of computers linked by transponders on SATCOM I, they offer intriguing possibilities for rural schools.

Few such technologies can be seen as offering "stand-alone" delivery capability, however. Educators need to remember that books remain the major carrier of information, even in a technological age. In fact, most examples of successful uses of technologies combine several modes of delivery into a coordinated or packaged approach.

Audio Teleconferencing

Teleconferencing implies the capability of having a conference or two-way conversation using telephone or audio technologies. Many of the telephone networks now in place use a four-wire dedicated system leased from a telephone company to link many locations in the state to a single communication system. Often this dedicated network can be connected to a variety of other locations, both within and outside of the state, by use of a teleconferencing bridge, which allows the user to set up long distance conference calls just as a long-distance operator would.

Expenses for audio teleconferencing include the rental of the lines, as well as purchase of inexpensive speaker phones or conferencing microphones. A teleconferencing bridge can be

purchased for about $30,000.

Videotape Lessons

Distribution of videotape lessons to learners at remote sites is a cost-effective method of upgrading curriculum offerings. The tapes themselves offer no opportunity for two-way communication between student and instructor, but the increased quality of instruction and the ability of students to stop and replay sections of lessons counter-balance this shortcoming.

The tapes themselves may be pre-produced, which allows for high standards of content and presentation but also increases developmental costs and adds time for production. Or they may be "candid" tapes of classes taught in a regular classroom setting. "Candid" programs are much less expensive to produce, and the instructional quality is as good as the instructor whose class is being recorded. Such tapes are rarely saved, but rather are erased so new lessons can be recorded over previous lessons.

Major expenses are the production facilities (obviously less for "candid" lessons) and distribution costs of getting the tapes to the learners in a timely manner.

Interactive Television

Real-time two-way visual contact between instructor and student is possible with technology on the market today. Carriers of the television signal can be microwaves, cable television systems, satellites, or low-power or sideband signals carried on a regular broadcast signal.

Most systems involve schools that are fairly close geographically. A teacher in one school also has television students in

neighboring schools. The teacher can see and often hear remote students via interactive TV. Microwave and cable signals can accomplish this with relative ease, while satellite-linked schools need uplink facilities from each location to achieve the same goal.

ITFS incorporates an audio return in most cases, but does not handily accomodate two-way visual interaction without development of another complete system duplicating the service area of the first.

All such systems increase costs significantly over use of existing audio networks or videotape playback.

Interactive Video

Blending microcomputers with a video storage unit allows the learning sequence to be controlled by student performance. Either videodiscs or videotapes can be controlled by the computer program. Videodiscs have the advantage of total storage capacity, since they can store 54,000 frames of video on each side of a laser optic disc which is not subject to wear. Video tapes are less expensive to produce and the equipment is more readily available, but individual bits of information cannot be accessed as easily or accurately.

Schools may be able to take advantage of computers they already own to combine with a video system. Since lessons are driven by the computer program, sections of the disc or tape that become outdated can be skipped. The computer program can be updated as needed, and changes in the program can be forwarded to

participating schools through a telephone modem or other computer link.

The branching capabilities that exist in such systems can contribute to very efficient use of student and equipment time, since information that is not necessary for a given student can be bypassed by the program.

Costs for equipment are dropping rapidly, and student stations may soon approach the affordability range for most schools. Availability of programming remains a problem, due to high developmental costs and the confusion of competing technology standards.

Computer Networks

Either individual microcomputers or terminals to a mainframe computer can be linked in a variety of ways. Most frequently, a mainframe is surrounded by a swarm of terminals connected to its memory by wires. A series of microcomputers can serve as terminals for a larger comptuer, with the advantage of on-desk storage capacity. Not all of the calculations or uses require the mainframe to be connected, but it can still be used for storage of the student's work.

Statewide systems can be linked via microwave systems, or even the dedicated lines of a telephone network could be used. Most frequently, however, the link is accomplished through regular telephone lines and a modem. Satellites can also carry the signals from one computer to another.

Costs of establishing new systems is high, as is use of some already available networks. But innovations in the field promise

to drop costs into the range of affordability for many schools. Software availability remains a problem.

TECHNOLOGIES IN CURRENT USE

Category A: Audio Teleconferencing -- Multi-point telephone transmission of voice only.

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PROJECT

TELE-LANGUAGE for High School Students
University of Nebraska-Lincoln

DESCRIPTION

Foreign language instruction delivered to rural high schools via locally supervised independent study with scheduled telephone conference calls between teacher and high school class.

IMPLICATIONS FOR RURAL SCHOOLS

UNL initiated this project in response to new foreign language requirements for high school accreditation. The project adds teleconferencing to already developed and tested independent study courses in Spanish, French, German and Latin. Courses in other areas, such as TELE-PHYSICS, are also being tested.

COSTS

Schools pay tuition of $48 per semester, plus a site fee of $300 per course per semester and a conference phone rental of $25 per semester. Books and handling fees total approximately $24 per semester. Program costs are estimated to total slightly more than half of the comparable costs to deliver a conventional course, assuming a foreign language teacher could be hired.

COMMENT

First year response to this program drew approximately 200 enrollments in 20 districts. Initial feedback indicates the curriculum is too rigorous for the delivery schedule, so adjustments are being made to accomodate student response. Every-other-week teleconferences are being replaced by every week calls, and the length of the calls is being left to the teacher's discretion, rather than a fixed time limit. UNL's program enrolls high school students nationwide, and this teleconferencing supplement may soon be offered in other states.

CONTACT PERSON

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PROJECT

Kansas Regents Continuing Education Network
TELENET

DESCRIPTION

Audio Conferencing system using four-wire dedicated telephone network and telebridge to link many widespread sites for various instructional programs. Recently added slow-scan TV for one-way visual transmission. Thirty-five network locations plus 23 available via telebridge.

IMPLICATIONS FOR RURAL SCHOOLS

Low cost system delivering interactive instruction to widely scattered students, with emphasis on two-way aspect of system. "This is for discussion, not lecture," says Kruh. Since their "non-prime" corresponds to public school day, good chance to rent existing system for comparatively modest expense. Daytime charges for long distance service may be higher, but possibilities for negotiation remain.

COSTS

Existing dedicated lines were acquired at fairly low cost in 1970, and telebridge purchased before recent price hike. Rental of system during non-prime hours helps defray expenses. Remainder of funding from student fees ($10-15 for printed materials), and membership fees from Regents institutions ($17,000 per school). Network can be leased for $120/hour plus $6.50/hour/site.

COMMENT

Strong faculty and student support for program. Mini-courses for honors students have attracted Alaska Department of Education, and 50 Alaskan students are joining in discussions with pre-eminent scientists from across the U.S. Regular or remedial courses could be offered in the same manner for curriculum enrichment.

CONTACT PERSON

Jan Kruh, Director
Regents Network
Umberger 312
Kansas State University
Manhattan, KS 66506
(913) 532-5995

PROJECT

Wyoming Teleconferencing System
University of Wyoming

DESCRIPTION

Twenty-four port teleconferencing bridge installed in 1984 by the University of Wyoming and used in three college course offerings with videotapes and print components. Instructor hooks up to three sites and introduces the video lesson. After the video lesson is played locally at each site, the instructor returns to the audio net and conducts a seminar. University field reps monitor the local sites.

IMPLICATIONS FOR RURAL SCHOOLS

With its vast expanse, Wyoming constitutes a good field trial location for experimentation of this type. In the current offering, local sites are 200 to 350 miles away from Laramie. The project could be expanded into advanced placement credit or to the 36 high school correspondence courses now available through the University.

COSTS

Capital costs of $40,000 for the teleconferencing bridge include $27,000 for central equipment, rest for conference phones. State and local agencies pay $10 per hour per port for system use, plus line charges (about $10 per hour for 200 miles). High school tuition is $30 per 1/2 Carnegie Unit, plus books of $15 to $20.

COMMENT

The University may be ready to expand its use of the system and is interested in high school use. Since any of the 24 sites may be used for origination, local or regional resource sharing is possible. Enrollment so far is about 20 students per course.

CONTACT

Kenyon Griffin, Director of Extended Studies
University of Wyoming
Box 3302, University Station
Laramie, WY 82071
(307) 766-3152

PROJECT

Educational Teleconferencing Network
North Dakota School of Medicine

DESCRIPTION

ETN is an audio teleconferencing network with dedicated lines into 50 sites, most of them medical facilities. The system is available from 8 a.m. to 5 p.m. Monday, Wednesday and Friday and from 8 a.m. to 9 p.m. Tuesday and Thursday. Sites are within 30 to 40 miles of any resident.

IMPLICATIONS FOR RURAL SCHOOLS

Schools close to one of the sites may be able to use the network, but convenience would be a major discouraging factor. Local coordinators serve each site.

COSTS

A line charge of $75 per hour buys access to all 50 sites.

COMMENT

Local sites once included many public libraries, but they were dropped for lack of use. Since the network is not fully used, perhaps North Dakota schools could investigate putting lines into rural schools interested in use of the system.

CONTACT

Karen Thoms, ETN Coordinator
(701) 777-3205

PROJECT

South Dakota State Telecommunication Center

DESCRIPTION

ATT Quorum Teleconference Bridge with 24 lines utilizes state telephone network, a mixture of TIE and WATS lines, to set up teleconferences for state supported groups.

IMPLICATIONS FOR RURAL SCHOOLS

Since their costs are very low for any state agency, support for a rural schools project by the State Department of Education would insure low cost two-way audio network for students in South Dakota.
They are not now using the state network or conferencing capabilities for instructional purposes, and since the bulk of the time is devoted to administrative functions, daytime space is limited. However, use of conglomerate telephone lines means that lines can be added as needed. No use of or interest in any visual capability at this time.

COSTS

Charges for conference calls include $5 to originate the conference call, and 12 cents per minute per site.

COMMENT

Medical Center uses Darome bridge and conferencing equipment.

CONTACT PERSON

Jim Stein
Room 125
Foss Building
State Capitol Complex
Pierre, SD
(605) 773-3121

PROJECT

Tele-Learning with Tele-Board
Garfield County School District, Utah

DESCRIPTION

Telephone-based system consisting of both audio and micro-computer generated graphics transmitted over standard telephone lines.

IMPLICATIONS FOR RURAL SCHOOLS

Through a grant from the Utah State Office of Education, this joint program between Garfield County School District and Dixie College was originally designed to provide upper level trigonometry to four rural schools in the district. Three courses are taught this year in three schools, with per course enrollments averaging 4 to 7 students.

COSTS

Hardware costs $2700 per station including Apple IIe, modem and printer. A teaching classroom needs an extra monitor ($400). Custom software, designed for the project, is now being used at Mansfield University of Pennsylvania. Operating costs are estimated at one-third those of conventional courses.

COMMENT

Dedicated lines have proved less expensive than WATS lines, even for distances of up to 150 miles, but 800 numbers may be added to bring in more colleges. Community education courses may be added, and two other high schools have indicated interest.

CONTACT

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Superintendent of Schools
Garfield County School Dist.
145 East Center St.
Panquitch, UT 84759
(801) 676-8821

Vicki Ahlstrom
Project Director
Garfield County School Dist.
Tropic, UT

(801) 679-8719

PROJECT

Missouri Spanish Language Project

DESCRIPTION

A 30 half-hour video series in conversational Spanish, acquired from Miami-Dade Community College, has been meshed with a University of Missouri independent study high school course for delivery in two rural high school districts.

IMPLICATIONS FOR RURAL SCHOOLS

The two schools using these materials last year had quite different feelings about their experiences (one very positive, one negative), but both superintendents said they liked the model. Local supervision is an important element, as is rapid turnaround on students' papers from the distant teacher. Both those superintendents suggested a speaker phone hook-up would be helpful.

COSTS

Tuition is $38 per student, plus books of about $40. Each school contributed $3000 to acquire the video series, added to an identical amount from the University of Missouri. The University believes additional schools could be added for about $2000, enough to buy lifetime rights and to pay for both video and audiotapes.

COMMENT

Good program materials must be combined with solid local supervision, which was lacking in first year's trial. Only one school is involved this year, but the program could expand throughout the state.

CONTACT

Roger Young
Director of Independent Study
University of Missouri-Columbia
(314) 882-6431

PROJECT

SURGE, ERG
Colorado State University

DESCRIPTION

SURGE uses videotapes of "live" classes distributed across the state within two days of the class. Professors visit the remote sites to maintain contact with students, who can call with questions. (WATS lines available and most instructors have answering machines and return calls promptly.) Tapes are erased and reused. ERG courses are pre-produced in the studio, and do not involve a "candid classroom" setting. More reliance on inserted video material.

IMPLICATIONS FOR RURAL SCHOOLS

Videotapes of live classes limit production costs, and add topicality to material. Since many schools have playback equipment, and new videotape recorders/players have steadily decreased in cost, such a program may be within reach of most districts. Bicycling videotapes depends on reliable distribution system, which may present problems in some areas during bad weather.

COSTS

Both programs are self-supporting. Major SURGE costs include student camera operators, equipment, maintenance/repair, materials purchase, and shipping. Tuition higher than for on-campus courses.

COMMENT

Users of this system are very positive about the cost-effective way in which they can provide courses to students unable to come to campus because of work or travel limitations. Both SURGE and ERG students have high completion rates (as would be expected of professionals) and high achievement in courses.

CONTACT PERSON

Marcia Bankirer, Director
SURGE
Division of Continuing Studies
Colorado State University
Fort Collins, CO 80523
(303) 491-5203 or 5288

PROJECT

Two-Way Audio-Visual Instruction via Low Power TV
Eagle Bend High School, Minnesota

DESCRIPTION

Two-way audio-visual simultaneous connection among five rural high schools via low-power television. Teacher at any of the schools can relate to students at any or all of the other sites. Teachers, who volunteer for TV assignment, get in-service training.

IMPLICATIONS FOR RURAL SCHOOLS

Program initiated to expand foreign language programming in rural schools; now includes language, advanced math, English composition, arts, business shorthand, career education. With nearly five years experience, the project has considerable experience, but cost is a major problem.

COSTS

Total investment is estimated at $500,000, although cost of equipment has dropped considerably in five years. Operating costs per student last year were $600, and an average of 18 students were enrolled in each course. The program has had considerable grant support.

COMMENT

A model program with apparent high degree of academic success, but very high capital costs. Future expansion of the system is being considered. The project includes service to five schools and a new mode of transmission (fibre optics) could provide an opportunity for two other sites. The possibility of expanded community use is there and could prove beneficial.

CONTACT

Russ Martinson, Superintendent
Eagle Bend High School
Box 299
Eagle Bend, MN 56446
(218) 738-6442

PROJECT

Carroll Instructional Television Consortium
Illinois

DESCRIPTION

Simultaneous two-way video and audio communication on cable TV. Four schools in NW Illinois connected with cable network.

IMPLICATIONS FOR RURAL SCHOOLS

A good example of sharing resources for a common goal. Small schools can pool students in television classrooms to make instruction cost-effective. Equipment costs are substantially less then salary expenses for each school to pay a teacher for the ten years projected equipment life.

COSTS

Each school district responsible for its share of the expenses of teachers' salaries. One-time equipment costs including cameras, receivers, extra cable, etc., was $18,745. Cable rental guaranteed at $1600 per year for the first five years.

COMMENT

Faculty fears of controlling remote students and concern that the public could watch their classes were laid to rest. Cooperation among participating schools and teachers in like disciplines, adult education possibilities, and educational advantages of student use of equipment have been "exra benefits."

CONTACT PERSON

Joel McFadden
Superintendent of Schools
Lanark, IL
(815) 493-6301

PROJECT

Two Way Instructional Television (TWIT)
Morning Sun, IA

DESCRIPTION

Four Iowa schools are linked through microwave to an interactive television system. Each school has a tower and dish, and one classroom equipped with a color camera, a live microphone, two viewing monitors for the students, and a console television for the instructor to view the other classes.

IMPLICATIONS FOR RURAL SCHOOLS

The TWIT system was developed to provide course offerings in schools that did not have enough students to justify the expense of full-time staff for advanced or specialized courses. Offerings at this time include psychology, sociology, pre-calculus, and four levels of Spanish. Enrollment figures range from 15 to 18 in beginning level courses to a maximum of 10 students in advanced courses. Microwave allows two-way communication for less money than some other systems, but requires relatively short distances of under 30 miles to operate effectively.

COSTS

Funding came from a $200,000 Title IV ESEA grant. Costs vary with the terrain and microwave capabilities, but Telecom Engineering estimates the costs per school will vary from $25,000 to $60,000. Maintenance costs are minimal, and the life of the equipment is usually figured at ten years.

COMMENT

Participants are enthusiastic about TWIT, and have found it a good solution to their similar problems. Cooperation is essential, and the four schools even run on an identical schedule to facilitate scheduling TWIT students and instructors. Interest remains in adding a computer link, which would utilize a special modem to allow communication even while class is being taught, although no time line has been set.

CONTACT PERSON

Francis R. Davis
Superintendent of Schools
Morning Sun Community Schools
Morning Sun, IA 52640
(319) 868-7701

PROJECT

Accelerated Learning of Spanish by Satellite
Utah Department of Education

DESCRIPTION

Highly intensive, accelerated Spanish language program for junior and senior high students. Uses daily live satellite broadcasts, plus supervised on-site review and computer networking, with voice synthesizers. Twenty-nine schools enroll 800 students in the course.

IMPLICATIONS FOR RURAL SCHOOLS

Though still experimental, this project has attracted user school districts in Utah, Colorado, Nevada and Arkansas and demonstrates the outreach capability of a highly ambitious and costly combination of technologies. The project will probably undertake a nontraditional language, such as Japanese, as the next activity.

COST

Cost estimated at $1100 per class of 20 students. As classes are added at one site, the average per class cost drops considerably. All hardware extra.

COMMENT

As with many others, this project got off the ground with grant support, including $450,000 in equipment donated by IBM and underwriting from the Bonneville Corp. Total cost for start-up: $1.5 million. Though development has been rushed, student evaluations indicate good performance on standardized tests.

CONTACT PERSONS

Ken Neal, Project Director
Coordinator of Information Technologies
Utah Department of Education
(801) 533-5573

Christine Olson, Curriculum Director
Utah Department of Education
(801) 533-6040

PROJECT

TI-IN
Texas Satellite Project

DESCRIPTION

Two-channel full-time privately operated satellite distribution system delivering courses for high school juniors and seniors, plus in-service for teachers. Classes taught live by teachers for 55 minute periods, as required by Texas law, to 77 schools in Texas, plus schools in Arkansas and California.

IMPLICATIONS FOR RURAL SCHOOLS

This is another in a new crop of satellite distribution systems aimed at smaller schools but with a new twist: the distribution system is owned and operated by a private, for-profit corporation. Its existence indicates that the long-range cost-effectiveness of large systems may be defensible, and it supports the value of delivery systems combining student learning with staff development.

COSTS

Operating costs are calculated at $240 per student per semester hour. Districts pay $2000 to gain access to in-service programs for the entire year. Courses labeled student enrichment are delivered free, as are other in-service programs, for school board members and other school employees.

COMMENT

Systems such as this one deserve watching because of the historic inability of for-profit organizations to sustain success in this market. If local schools find the cost of these systems attractive, and if the courses offered resolve local problems, then there is no reason that schools outside Texas should not take advantage of them.

CONTACT PERSON

Pat Tinsley, President
TI-IN
100 East Nasas Road 1, Suite 201
Webster, TX 77598
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PROJECT

German by Satellite
Oklahoma State University A&S Teleconferencing Network

DESCRIPTION

German language delivered via live satellite telecasts combined with with computer-assisted instruction. The video lessons are fed twice a week for 30 weeks. Enrollment totaled 700 in the first full year of operations.

IMPLICATIONS FOR RURAL SCHOOLS

For large geographic areas or large enough student populations, satellite-delivered lessons offer increasing potential, especially as the cost of receiving dishes has come down. This project has enrolled some students from other states, but it is clear that Oklahoma State will put its priority on serving resident students.

COST

Schools pay a $1550 subscription fee for 30 weeks of live programming, delivered twice weekly for 45 minutes each. A companion "enrichment series" on a variety of (non-foreign-language topics) is available for $950 (once per week). Schools also install their own satellite dishes and must provide other equipment, including computers, software, cassette recorders, and cassette control devices.

COMMENT

This project, like others with comprehensive technology delivery systems, requires significant upfront investments for software and hardware, as well as highly dedicated teachers and administrators who are willing to take risks. OSU is planning to offer physics and elementary-level German by next year, and is studying both Russian and Japanese as possible additions to the satellite-delivered language curriculum.

CONTACT

Sheila A. Wisherd, Coordinator
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PROJECT

Interactive Videodisc for Legal Education

DESCRIPTION

Interactive, highly branched computer managed videodisc showing trial techniques, used as a transition device between sequential courses in basic evidence and trial advocacy. Uses two-screen system: one for disc displaying courtroom scenario and action, and one for computer with text and prompts.

IMPLICATIONS FOR RURAL SCHOOLS

Interactive system using self-contained and self-paced computer managed and assisted instruction. Technology prices are coming down to a point of real affordability for smaller schools ($1500 per station according to Nebr. Videodisc Production Group). Disc replication costs are becoming attractive, considering life of each disc. Changes are easily made in program, so outdated portions of video on disc can be skipped.

COSTS

$80,000 grant for development of disc let two people work part time during the school year, and long hours during the summer. Hardware cost totaled $12,000, but are lower now. They are now reprogramming to use the IBM-PC or Sony 2000. making costs more in $4000 per station range. A Law School already owning micros could have the system for under $2000.

COMMENT

Lack of standardization in videodisc technology means limited courseware is now available. One big push could tip a project into standardization by default. Courseware developed by teachers or schools for standardized system could be profitable for developers. Disc production cost brings price into $300 range, so cost per use gets lower.

CONTACT PERSON

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Lincoln, Nebraska 68508
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PROJECT

Paragraph Principles
Indian Valley Colleges
Norato, California

DESCRIPTION

An interactive videotape course in writing paragraphs, developed by staff and produced by an instructor in TV production, with aid from work-study students.

IMPLICATIONS FOR RURAL SCHOOLS

Technology of interactive videotape production is fairly inexpensive compared to other technologies. Uses Apple II+ micro for CAI, teaching principles of writing, with visual presentation of a variety of examples. The applications portion, during which students write paragraphs for instructor critique, occupies second four weeks of the course.

Editing was done with two Sony 2860 recorders and a Convergence ECS-90 editing controller. Production facilities were available at Indian Valley Colleges.

COSTS

A "small grant" paid for film, tape and some of the time spent on the project, so the budget was limited. Videotape players and computers to manage the interactive system would be the major hardware expenses.

COMMENT

Recording ability of videotape over videodisc suggests an advantage for videotape technology. "Homegrown" courseware can be both application-specific and economical for sharing.

CONTACT PERSON

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PROJECT

Kentucky Schools Technology Project

DESCRIPTION

Interactive computer network linked by existing statewide microwave system. Multi-drop from microwave with 600 voice-grade circuits. Centralized computer using hardware and software developed by Computer Curriculum Corporation (CCC) of Palo Alto, CA (800 227-8324). Project aimed at middle school students, including remedial. In 1984-85, 1,782 students were enrolled in 21 schools.

IMPLICATIONS FOR RURAL SCHOOLS

Software includes math, reading, and is highly branched and diagnostic. Ten minutes per student per day seems effective. May add computer interactive videotape. Kentucky system could be replicated with dedicated lines. (Seventeen South Carolina schools are linked with modems.) Also has "Dial-a-Drill" for homework or practice from terminal outside of school.

COSTS

Since microwave system was already in place, costs are not available for that portion of project. "We'll pay for the multi-plex in a couple of years," according to Anderson.

On-line all the time, so computer costs fairly high. One system consisting of computer with 64 terminals will be in the $200,000 range, and includes all hardware and perpetual license for software. Most efficient operating cost: $2.56 per hour; $27.71 for one year gain in basic skills.

COMMENT

"Software is powerful, not pretty," says Anderson. CCC has gotten "good reviews" from schools using the system.

Comparative effectiveness of using terminals vs. micros is presently being evaluated with 1300 students on the two systems.

CONTACT PERSON

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PROJECT

National Information Utilities (NIU) Corp.

DESCRIPTION

Satellite linked computer network designed to provide varied informational services and programming to member schools. Uses FM sideband to deliver information, and has a very sophisticated verification procedure which helps insure accuracy of information transmitted.

IMPLICATIONS FOR RURAL SCHOOLS

Maryland is the testing ground for the system at this time. If the project is successful, the state wants to eqiup 100 schools with the technology by the end of 1985. Computer networking of some variety may prove to be a very cost-effective way of sharing information, particularly in schools interested in CAI.

COSTS

Originator Jack R. Taub estimates that it would cost local school systems about $750 per student desk to buy the computer hardware and to pay for teacher training. Use of the data bank would cost about 50 cents an hour. Use of subcarrier channels, which are buried within broadcast channels, is a less expensive alternative to using telephone lines.

The state of Virginia has applied for a $186,752 grant to test the technology in an application for more than 2000 special education home-bound students.

COMMENT

Costs are likely to be high unless an inexpensive delivery system can be found. Access to satellite transmissions should not be a problem. It's probably too soon to draw conclusions about potential effectiveness.

CONTACT PERSON

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PROJECT

TeleLearning's Electronic University Network

DESCRIPTION

A commercial telecommunications service providing easy-to-use electronic mail connection between student and teacher. Requires student and teacher each to have access to microcomputer and modem. Software initiates phone calls to nearest packet switching node; hook-up and transmissions handled automatically.

IMPLICATIONS FOR RURAL SCHOOLS

Provides turnkey operation for instructional users with access to IBM, Apple and Commodore computers. Students could communicate with teachers anywhere in the United States. Most rural schools would have to pay a telephone toll charge to get from school site to the nearest node.

COSTS

Student enrollment package (with modem) runs $170 to $230 retail; instructor package (without modem) is $200. School pays $15 per enrollment for system use plus communications costs averaging $1.50 per student-teacher interaction.

COMMENT

First high school course use of the system scheduled for 1986 through the University of Nebraska-Lincoln Independent Study High School.

CONTACT

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PROJECT

CADET
Computer Assisted Distance Education Telecommunication

DESCRIPTION

Computer networking allowing multiple-user access, including downloading, back-up, monitoring, packet switching for secure transmission, adapting mainframe to different micros, and providing larger memory capacity.

Using micros as self-contained units with access to mainframe minimizes use of the mainframe, cutting connect costs, since telephone lines are used.

IMPLICATIONS FOR RURAL SCHOOLS

Reducing on-line charges and telephone bills makes linking with mainframe computers possible from greater distances and in greater numbers. Software includes protocol communication program such as Visiterm (VisiCorp, Inc.) and a text editor such as Magic Window (Artsi, Inc.), pluys a modem to "call" the mainframe.

Cost-effective way of transmitting programs to distant centers from central control site or school. Both CAI and CMI capabilities present.

COSTS

Costs include any micros not already in place, a mainframe with time enough to deal with access demands of member schools, and fairly minimal connect charges and telephone line charges. May be an inexpensive alternative to installing an entire system.

COMMENT

There may be some limits to compatability of equipment now owned by target schools. Need additional information on any limitations, and how to adapt to them.

CONTACT PERSON

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DELIVERY SYSTEMS BY STATE

	PUBLIC TELEVISION	PUBLIC RADIO	TELEPHONE NETWORK	CABLE TELEVISION
COLORADO	3 Stations Broomfield, Denver Pueblo	3 Stations All FM 30-70 mi. range	Two national firms headquartered in Colorado	105 systems serve 203 communities--348,945 subscribers, 281,912 pay units
KANSAS	3 Stations Bunker Hill, Topeka, Wichita	5 Stations 4 FM (40-100 mi. range) 1 AM (250 mi. range)	TELENET Dedicated lines with bridge, statewide	211 systems serve 278 communities--441,271 subscribers, 250,681 pay units
MISSOURI	4 Stations Kansas City, Springfield, St. Louis, Warrensburg	9 Stations All FM 28-100 mi. range	Operated by Ag Extension	185 systems serve 396 communities--520,239 subscribers, 480,943 pay units*
NEBRASKA	2 Originating stations, 9 transmitters on KUON's statewide network	3 Stations All FM (50-75 mi. range) 1 Lincoln, 2 Omaha	UNCEAN Dedicated lines link 9 sites, others by bridge	104 systems serve 140 communities--260,523 subscribers, 224,265 pay units
NORTH DAKOTA	6 Stations linked in statewide network	4 Stations 3 FM (45-90 mi. range) 1 AM (75 mi. range)	ETN, School of Medicine Dedicated lines to 50 sites	106 systems serve 119 communities--114,619 subscribers, 23,194 pay units
SOUTH DAKOTA	7 Stations linked in network covering most of state	3 Stations 1 FM (not yet qualified) 2 AM (35-150 mi. range)	State Telephone Network Bridge to set up conference calls	77 systems serve 92 communities--89,143 subscribers, 36,470 pay units
WYOMING	1 Station Riverton	1 FM Station Laramie (100 mi. range)	REDI-NET Telephone Conferencing System, with bridge	48 systems serve 88 communities--112,348 subscribers, 66,018 pay units

* 58 cable franchises are not operating at this time, or are not yet operating.

SUMMARY

Rural school policy makers have access to an increasing variety of technologies to expand high school curricula through cooperative arrangements with other high schools, colleges and universities, and state departments of education.

Fortunately, a growing number of models exist which demonstrate how various technologies are being used -- right now -- by school districts facing such challenges. Since the models run the gamut from low-cost, readily available technologies through high-cost, high-risk delivery systems, their existence constitutes a valuable starting place for any school district interested in surveying current practice for possible adaptation to its local environment.

Fortunately, many such models exist within the McREL region or in other states in the Midwest and Great Plains, so examples from which rural high schools might learn are not far away.

Rural school districts interested in applying technological means to solving current educational problems need to keep in mind, however, these three cautions:

> First, the most exotic technologies are not necessarily the most practical for immediate use.
>
> Second, resource sharing is essential.
>
> Third, the major roadblocks are usually political, not technological.

Appeal vs. Practicality

Educators naturally are attracted to such appealing technologies as videodisc-microcomputer interfaces and satellite

conferencing. The videodisc, especially, interests educators because it represents the cutting edge of educational technologies and a meshing of video, programmed instruction and text. The potential instructional power is obvious.

Unfortunately, perhaps, the most exotic technologies are not necessarily those most in reach of rural schools. What technologies are most readily available? They tend to be the technologies that are older, most affordable, and easiest to implement:

* audio and video lessons played back in the local school
* telephone conferencing systems or networks
* independent study by correspondence, combined with local supervision and perhaps on-site visits by the instructor
* some combination of these delivery systems

There are, however, a growing number of examples of rural school districts linking their high schools through interactive TV systems (ITFS, cable, or microwave). Some systems offer two-way audio and video transmissions, with TV classroom equipment that is becoming affordable for most districts. The distribution system itself, however, can be quite expensive, though consortia may find the cost per district -- amortized over several years -- a defensible expenditure when compared with the costs of highly labor- and/or travel-extensive strategies.

Resource Sharing

Resource sharing among districts and with other educational agencies is also becoming more common, as the growing number of examples illustrates.

There is little, if any, argument that resource sharing is an essential element to successful use of delivery systems available to rural schools. The opportunities extend throughout states and, with advancing technologies, even across state boundaries.

A simple example is the independent study program offered by a college or university. Within the McREL region, several state universities offer high school and college independent study courses for enrollment by college students. Two of the nation's largest high school independent study programs are located within the region, and both of them are using technologies to expand their outreach capability and to increase effectiveness of their programs.

Schools interested in use of certain technologies -- interactive television is the premier example -- will have to employ resource sharing to make affordable their access to distribution equipment. And they will need to share teachers and other resource persons to protect themselves from investing new resources in technologies and then also expending district funds for more personnel. A good science teacher can, through technology, teach science courses in several high schools without the time or expense of travel.

State departments of education and colleges and universities often are the managers of instructional televison systems, audio teleconferencing bridges and computer networks -- all offering means to enable resource sharing. Those institutions themselves may be interesting in joining in a cooperative approach to

benefit themselves as well as the local districts involved.

In any resource sharing arrangement, however, it is important to establish a structure which:

* clarifies roles and expectations of the partnership as a whole and of each of the partners individually.

* establishes an ongoing communications mechanism which forces the partners to share information regularly.

* provides for periodic evaluation and assessment -- even if relatively informal -- to make sure that effectiveness is assessed and that alterations based on common data are acceptable.

Barriers to Change

Finally, it is important to remember that most of the barriers to change will be political and not technological.

Questions about what technologies might be employed, how they might be employed, and at what cost are questions that can be answered by the technical experts. The policy makers will have to deal with such questions as:

* who pays how much
* who leads and who follows
* who offers what courses and when
* who is in charge and who is not

Fortunately, there are also growing numbers of examples indicating that these kinds of questions also can be answered satisfactorily. Many of the model projects thrive because of the willingness of partners to agree on the political issues as well as the technological ones.

An Update

In the year since the first issue of this report was prepared, a number of new projects have emerged that

demonstrate the exciting potential for significant advancement in uses of technologies when large numbers of school districts are involved. Those projects -- and many others reported here and in other similar documents -- suggest that we may be headed toward a period of renewed development of technological potential on a large scale.

There is also something to be said for projects planned on a smaller scale, where upfront commitments are counted in cooperation more than currency. Clearly, changes in practice can be made in both large and small projects. Where rural schools are involved, the smaller projects may do as well in the long run.

If there were some rules for implementation of new technologies, they would surely encompass a number of principles borrowed from the pages of entrepreneurial success stories. Successful entrepreneurial organizations, for example, learn quickly to:

a. Generate and screen new ideas
b. Develop and test new concepts
c. Analyze new opportunities
d. Implement innovations successfully

Successful innovators protect their risks -- and the risks of their stockholders or constituents -- by planning innovations that promise:

a. big potential impact
b. small cost for implementation
c. short time for completion
d. high visibility if successful

Small organizations, especially, often have a better chance of adapting to changes. Organizations led by professional managers also enjoy more flexibility in response to environmental change and often are key to establishing readiness to realign

strategies in line with new opportunities.

Any organization will succeed in making major changes if it positions itself for success with these additional measures:

* Make an institutional commitment, from the policy level throughout the management team, and decide what expectations will accompany that commitment.

* Get the natural leaders involved, early and ambitiously, so that their affiliation will establish a model for others.

* Move from established organizational expertise and strength, rather than trying to develop new expertise essential to the change strategy.

* Don't engage in multiple innovations -- innovate a step at a time, rather than trying to transform the organization into something entirely different overnight.

* Anticipate some failure, and be prepared to overcome it, rather than letting it overcome you.